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ABSTRACT

Learning style is the foundation of successful teaching and teaching for thinking. The recent conceptualization of the brain as a complex system for processing and storing information can be meaningful to educators. Too many schools, however, rely on a rather mechanistic approach to learning. Future school administrators must be taught to understand information processing as a part of learning. Most early research into learning style was too preoccupied with finding the one perceptual mode that would best increase learning or retention. In 1937, however, Allport coined the term "cognitive style," and research in this area expanded greatly after World War II. In the 1950s the term "learning style" began to be used in discussing the dynamics of groups at work, and current efforts to explain the underlying processes of learning reflect three lines of research, the first emphasizing the cognitive style; the second stressing students self-perceptions; and the third resting heavily on personality theory. In 1979, the National Association of Secondary School Principals (NASSP) helped establish the National Learning Styles Network to study developing learning styles research. The Network proposed that all information must pass through an individual's information processing system to be learned, retained, and recalled. The Task Force adopted a research model in which learning style encompasses cognitive, affective, and physiological/environmental dimensions. The NASSP also developed the Learning Style Profile (LSP) designed to give teachers an easy way to determine learning styles in middle level and senior high school students. The LSP diagnoses student's cognitive styles, perceptual response tendencies, and study/instructional preferences. As a first-level diagnostic, the LSP can be used to create individual student profiles or group profiles that are useful in creating learning style-based instruction. Sample questions from the LSP are included. Contains 26 references. (JPT)

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PROFESSORS OF SECONDARY SCHOOL ADMINISTRATION AND SUPERVISION (PSSAS)
INSTRUCTIONAL LEADERSHIP SERIES

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LEARNING STYLE: COGNITIVE AND THINKING SKILLS

JAMES W. KEEFE

U.S. DEPARTMENT OF EDUCATION
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James W. Keefe is the NASSP director of research; he is principal co-author of the NASSP Learning Style Profile and related publications.

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Introduction to the Series

The Instructional Leadership Series was developed by the Committee of Professors of Secondary School Administration and Supervision (PSSAS) of the National Association of Secondary School Principals to serve as a resource for professors engaged in preparing principals and other school administrators. It is not a curriculum guide, nor a text for instruction. Rather, it is a compilation of practical strategies and procedures that any professor may use in college courses and training sessions for aspiring or practicing school administrators.

Topics for this series were chosen by PSSAS Committee members, using a priority grid process, from among the range of subjects treated in NASSP's *Instructional Leadership Handbook* (Keefe and Jenkins, 1984, 1990).

All principals, and particularly middle and high school principals, feel the mounting expectation to serve as the instructional leaders of their schools. The education community, state and federal policymakers, and shifting community and board demands place matters of teaching and learning squarely on the principal's desk. Supervision, staff development, curriculum development, planning, and program evaluation are now indisputably the bailiwick of the principal. Teachers' instructional performance—and student outcomes—are shaped by the principal's leadership.

This perspective on the principal's growing importance and function shifts the sands of university courses, internships, textbooks, and other preparation experiences. College and university professors experience new demands on their teaching, demands to prepare principals with broader technical knowledge as well as with newly understood conceptual tools for leadership and pedagogical improvement. Inevitably, professors discover need for restructured courses, reconceived field-based experiences, and resources for retooling their work with current and future principals.

The Instructional Leadership Series responds to this need for newly conceived resources. It is the product of a multi-year project begun in 1986. The series modestly proposes to relay useful ideas to professors and others who are engaged in the education and development of principals. Although many of the units and ideas in the series are familiar, all are written with the principal's instructional leadership function in the forefront. Written and reviewed by other professors intimately involved in principal preparation, each unit in the series aims to assist professors in preparing men and women wise to the complexities and joys of the teaching-learning process.

The PSSAS committee invites the reader to use the ideas and procedures in this unit. It is packaged to permit easy integration into existing practices and to encourage further reading and planning. The Committee welcomes suggestions from NASSP members and other users of the series for additional topics of interest.

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Learning Style: Cognitive and Thinking Skills

Learning style is both a student characteristic and an instructional strategy. As a student characteristic, learning style indicates how a student learns and likes to learn. As an instructional strategy, it informs the cognition, context, and content of learning. From either point of view, it is the foundation of successful thinking and teaching for thinking.

In recent years, many psychologists have come to view the brain as a very complex system for processing and storing information. This conceptualization of human learning as information processing, storage, and use can be meaningful to educators. Most educators believe that the acquisition and use of basic knowledge and skills is the primary purpose of schooling. Research on information processing sheds a great deal of light on how knowledge is acquired, stored, and recalled.

The process by which the brain systematically collects information is known as perception. Perception in turn is related to memory—both storage and recall—and to the processes by which each human being develops, organizes knowledge, and uses language. An understanding of information processing is a *sine qua non* for understanding human learning and development.

Too many schools rely on a rather mechanistic approach to learning. An information processing view can begin to suggest a more appropriate set of questions that educators can ask about learning and instruction. Some of the most important questions are suggested by Letteri (1982):

- How does information enter the learning system?
- How is it processed?
- How is it stored in the brain?
- How is it retrieved for problem solving or new learning?
- How should information be sequenced, organized, and presented for appropriate instruction?
- What are the implications of an information processing view for match-mismatch approaches to instructional organization?

These questions obviously cut across every function and task of schooling. They challenge the organization of the learning environment, the choice of instructional methodology, and the ways teachers interact with individual students.

Professors who prepare prospective school administrators for instructional leadership must be familiar with the construct of style, able to model various applications in the classroom and in field settings, and prepared to help administrators become expert in style assessment and enhancement. Implicit in these tasks are the various aspects of style theory and practice that we will treat in this unit:

- Research Background
- Definition and Conceptualization
- Style Assessment
- Instructional Applications
- Learning Style and Thinking
- References
- Appendix: A Sample Profile.

Research Background

Elements of learning style appeared in the research literature as early as 1892. Most of that early research (before 1940) concerned the relationship between memory and oral or visual teaching methods. The findings were conflicting, no doubt due in large part to the differences in the populations, learning materials, and test instrumentation that were utilized.

Most early researchers were too preoccupied with finding the one perceptual mode that would best increase learning or retention. Even before 1900, Cattell and Jostrow attempted to relate differences in perceptual mode to general intelligence and learning performance without success. Vernon, Eysench, and others described perceptual typologies such as analyzers vs. synthesizers and color vs. form reactors.

The term "cognitive style" was coined by Allport in 1937 to refer to a quality of living and adapting influenced by distinctive personality types. In the 1940s, Thurstone and later Guilford identified factors of perceptual speed and flexibility (through the techniques of factor analysis) which they believed were related to personality.

Specific research on cognitive styles was greatly expanded after World War II at Brooklyn College, the Menninger Foundation, and the Fels Institute. Asch and Witkin at Brooklyn College worked with the bipolar trait of "field dependence-independence," the ability of a person to identify a figure against a background field. In time, Witkin and his associates broadened this notion to include "analytic-global" functions and the concept of

"psychological differentiation."

Holzman, Gardner, and others at the Menninger group concentrated on cognitive style as a complexus of cognitive controls. At the Fels Institute, Kagan and his colleagues focused on analytic and non-analytic modes which led to the identification of a "reflection-impulsivity" dimension. The reflective person tends to analyze and thoroughly differentiate a complex concept; an impulsive person is inclined to make quick and often erroneous responses.

Although differences in criterion tests used to measure the variables make comparisons a bit shaky, Davis (1967) saw a similar active-passive dimension in the work of the Brooklyn, Menninger, and Fels groups, as follows:

Active Analysis		**Passive Acceptance**
Field Independence	(Witkin)	Field dependence
Differentiation	(Gardner)	Undifferentiation
Reflection	(Kagan)	Impulsivity

The consideration of cognitive style widened after 1960 to include selection strategies (scanning and focusing), open/closed-mindedness, memory or retention styles, risk taking vs. cautiousness, and sensory modality preferences (kinesthetic, visual, and auditory).

The term "learning style" was probably first used by Thelen (1954) in discussing the dynamics of groups at work. Current efforts to explain the underlying processes of learning reflect three lines of research. The first emphasizes the cognitive style dimension. Most cognitive styles are bipolar, like analytic vs. non-analytic or reflective vs. impulsive. Kolb (1976) and Gregorc (1978) developed similar bi-dimensional cognitive models that are still widely used. Letteri's (1980) Cognitive Profile is a sophisticated multi-dimensional version of this approach.

A second group is working with applied models of learning style (e.g., Dunn and Dunn, 1978; Hunt et al., 1978). Interview techniques or self-report questionnaires are used to identify student perceptions of their own characteristic traits. This approach often uses research similar to Aptitude-Treatment Interaction (ATI) analysis (Cronbach and Snow, 1977). ATI is a systematic attempt to relate individual differences in aptitude, including aspects of cognitive and affective style, to instructional method.

The third line of research rests heavily on personality theory, particularly the psychological type theory of Carl Jung. Several analyses of the Jungian thesis have been formulated and application made to learning style, teaching style, and instructional diagnosis (Lawrence, 1979; Silver and Hanson, 1980; Myers and Myers, 1980). Cognitive approaches also look to Jungian and non-Jungian personality theory for one of their ultimate justifications.

Learning Styles Task Force

In 1979, the National Association of Secondary School Principals began co-sponsoring, with St. John's University of New York, a National Learning Styles Network. The NASSP monograph *Student Learning Style: Diagnosing and Prescribing Programs* was published later that same year to summarize various developing learning style approaches. In 1981, a major conference was sponsored by the Network to bring together many of the leading persons in the field to discuss and exchange information. NASSP issued selected conference papers in the publication, *Student Learning Styles and Brain Behavior: Programs, Instrumentation, Research.*

In 1982, NASSP assembled a distinguished task force to examine current conceptualizations and instrumentation of learning style. The task force spent four years examining some 40 elements of style, developing a conceptual model, and initiating massive factor analytic studies leading to a new instrument of learning style.

After much debate and considerable disagreement, the group adopted an information processing model as the underlying rationale for theory and instrument development. Letteri's "General Operations Model" (1982) was chosen as the primary basis for relating cognitive/learning style to information processing theory. The model proposes a useful synthesis. (Figure 1)

All subject matter is information that must pass through the individual's information processing system to be learned, retained, and recalled. Information is received from the external environment through the senses (perception) and stored briefly in perceptual memory. Then, the mind makes a decision—based on the physical characteristics of an object, or attitudinal criteria—about what to do with a given message. It may reject the information, memorize it for short-term recall, transform it to conform to prior messages, or learn it by integrating, assimilating, differentiating, or associating it in working and long-term memory. The end result is a changed cognitive structure for the individual.

Cognitive styles are controls that are intrinsic to this information processing system. These cognitive controls, in turn, are influenced by various motivational biases and environmental preferences that the individual brings to learning. The gestalt of cognitive, affective, and environmental elements is what we term learning style.

Definition and Conceptualization

The Task Force adopted a research model of style proposed by Keefe (1979). This model viewed "learning style" as an umbrella term encompassing cognitive, affective,

and physiological/environmental dimensions. Based on this conceptualization, the Task Force developed a set of working definitions for a multi-dimensional view of style. These definitions provide a useful starting point for understanding the instrumentation and applications of style.

❖ *Learning Style* is the composite of characteristic cognitive, affective, and physiological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. It is demonstrated in that pattern of behavior and performance by which an individual approaches educational experiences. Its basis lies in the structure of neural organization and personality which both molds and is molded by human development and the learning experiences of home, school, and society (Keefe and Languis, 1983).

❖ *Cognitive Styles* are the information processing habits . . . which represent a person's typical modes of perceiving, thinking, remembering, and problem solving (Messick, 1969).

❖ *Affective Styles* are motivational processes—attention, expectancy, incentive—viewed as the learner's typical modes of arousing, directing, and sustaining behavior (Keefe, 1979).

❖ *Physiological Styles* are biologically-based modes of response that are founded on sex-related differences, personal nutrition and health, and accustomed reaction to the physical environment (Keefe, 1979).

A long-standing philosophical difference of opinion exists over the relative merits of remediational versus adaptational approaches to style. Adaptationists argue for changing only the learning environment, not retraining the child. They stress the value of individual differences and stylistic variations, and that emphasis be placed on a variety of learning environments, multiple resources, variable instructional methodologies, and flexible teaching.

Clinicians, on the other hand, stress the importance of retraining learner cognitive skills for coping with existing learning environments. They contend that some cognitive skills are more productive of school achievement than others, and that sometimes learner skills need to be augmented (remediated) for any real learning to take place.

The NASSP Task Force acknowledged the validity of both positions depending on the learner's age, developmental maturity, and level of skill.

❖ All students can benefit both from a responsive learning environment and from the enhancement of their learning skills.

❖ Some students require more augmentation than adaptation. Their cognitive skills are unproductive; changes in learning environment will not much improve their learning.

❖ Some students with basically sound cognitive skills profit from careful matching of the learning environment to their personal learning style profile.

Augmentation is more suited to cognitive style "growth"; adaptation to affective and physiological style "matching." In general, then, you augment the cognitive and adapt the affective and physiological (Keefe, 1984).

Style Assessment

The NASSP published a new learning style instrument in 1986—the NASSP Learning Style Profile (LSP). The Profile (Keefe et al., 1986, 1989) is second-generation technology, yielding independent scores on 24 discrete elements of style, building on the research and design of earlier work in the field. Its purpose is to provide educators with a well-validated and easy-to-use instrument for diagnosing the cognitive styles, perceptual response tendencies, and study/instructional preferences of middle level and senior high school students. The Profile offers school practitioners a way to personalize the instructional process, to identify the dominant stylistic characteristics of students, and to plan instruction accordingly.

NASSP task force research identified 24 significant perceptual responses, cognitive styles, motivational orientations, and environmental preferences. Second-order analyses grouped these elements into four higher factors:

1. Three perceptual responses (visual, auditory, emotive)
2. Eight cognitive or information processing styles (sequential processing, simultaneous processing, discrimination, analytic, spatial, memory, categorization, and verbal-spatial)
3. Six study preferences (persistence, posture, mobility, sound, lighting, and afternoon study time; evening study time preference did not load in this analysis, but may be thought of as a study preference)
4. Six instructional preferences (verbal risk, grouping, manipulative, temperature, early and late morning study time).

These factors can also be conceptualized in information processing terms as cognition and context (see Figure 2). Cognition includes perceptual responses and cognitive

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controls. Context covers the study and instructional environment. The relationships among LSP perceptual response subscales and cognitive controls shown in Figure 2 are based on typical human information processing patterns. The individual responds to external or internal stimuli (perceptual mode), and the information is automatically processed both sequentially and simultaneously. The individual exercises personal preference in discriminating among sequential and simultaneous data.

The data are further subjected to analytic and spatial controls, held in short-term or working memory and then categorized in long-term memory (or rejected). This processing all takes place in the context of verbal-spatial, study, and instructional preferences. (See the *LSP Technical Manual*, Keefe and Monk, 1988, for more detail.)

The Learning Style Profile contains the following subscales, organized here by the higher-order factors or dimensions.

Cognitive Skills

1. *Analytic Skill* (AS) is the capability of identifying figures concealed (embedded) in a complex background field. Persons high in this skill excel in separating a part from a whole and in using the critical element of a problem in a different way.

2. *Spatial Skill* (SS) assesses two generally accepted components of spatial reasoning—pattern recognition and spatial rotation. Pattern recognition is the capability of identifying a pattern, remembering it, and discriminating it from other similar patterns. Spatial rotation is the capacity to rotate objects in the imagination.

3. *Discrimination Skill* (DS) is the capability of focusing attention on the required dimensions of a task and avoiding distractions. This subscale is modeled on the cognitive style of focusing/scanning.

4. *Categorization Skill* (CS) assesses variations in categorizing behavior. Narrow categorizers tend to use more complete and more accurate categories to classify information. Broad categorizers lack accuracy and organization in creating adequate categories for new information.

5. *Sequential Processing Skill* (SQP) refers to a learner's capability or bias for processing information in a step-by-step, linear fashion. Verbal processing, for example, is sequential, but a sequential task need not be verbal. Any step-by-step process (like mathematical computation) qualifies.

6. *Simultaneous Processing Skill* (SMP) is the capability or bias for integrating the separate elements of experience into a whole, or gestalt. Simultaneous processing often has a strong spatial or visual component but the task does not have to be spatial. Persons high on this subscale are skilled in relational thinking; i.e., perceiving an overall pattern from the relationships among the parts.

7. *Memory Skill* (MS) is based on the cognitive style of leveling vs. sharpening. Sharpeners show strength in differentiating new information from old; levelers do not. The subscale assesses a learner's capacity to retain distinct rather than vague images in repeated tasks—to detect and identify subtle changes in information.

8. *Verbal-Spatial Preference* (VSP) loads with the cognitive factors in subscale analysis. This subscale assesses a learner's preference for dealing with verbal or spatial *tasks*. The subscale grew out of exploratory factor analysis of test items representing preferences for learning from visual rather than verbal stimuli (e.g., films rather than books).

Peceptual Response

9. *Visual Perceptual Response* (VPR) characterizes the learner who tends to respond to new information in a visual or pictorial fashion. Perception is the individual's immediate reaction to sensory stimuli. Visual learners prefer visual, pictorial, or graphic representations of experience.

10. *Auditory Perceptual Response* (APR) characterizes the learner who responds to new information in an auditory or listening fashion. Auditory listeners like to listen to others talk about experience.

11. *Emotive Perceptual Response* (EPR) characterizes the learner who responds to new information in terms of its feeling. Emotive learners react initially to the physiological or emotional tone of an experience.

Study and Instructional Preferences

12. *Persistence Orientation* (PO) is the willingness to sustain behavior beyond the required time, to withstand discomfort, and to face the prospect of failure. The low-persistence learner usually has a short attention span and gives up easily on demanding tasks.

13. *Verbal Risk Orientation* (VRO) measures a student's willingness to verbalize, to speak out, and to state opinions even if others disagree. The subscale

emerged from exploratory factor analysis of items representing physical or mental risk taking, tolerance for anxiety, and an active/reflective dimension similar to the "extraversion/introversion" scales of the Myers-Briggs Type Indicator.

14. *Manipulative Preference* (MNP) characterizes the learner who likes "hands-on" learning activities. The subscale arose from exploratory factor analysis of items written to assess tactile and kinesthetic modality preferences, but no correlation exists between this subscale and perceptual response. Manipulative learners apparently like to build, fix, make, or put things together regardless of their initial perceptual response.

Study Time Preferences: These preferences derive from the natural rhythms of the body (i.e., circadian rhythms, early childhood sleeping and waking patterns, and temperature variations). Students are more or less ready to learn depending on the time of the day.

15. *Early Morning Preference* (EMP) characterizes preference for studying and learning in the early morning.
16. *Late Morning Preference* (LMP) characterizes preference for studying and learning in the late morning.
17. *Afternoon Preference* (AP) characterizes preference for studying and learning in the afternoon.
18. *Evening Preference* (EP) characterizes preference for studying and learning in the evening.
19. *Grouping Preference* (GP) measures individual preferences for whole class, small group, or dyadic ("buddy") learning arrangements. The effect on achievement of matched and mismatched student grouping preferences seems to depend greatly on student attitudes toward subject and self.
20. *Posture Preference* (PP) characterizes learner bent for formal or informal study arrangements and related bodily postures. A student who prefers a formal arrangement will choose to work in an upright posture at a desk or table. A student with informal preferences will choose a more relaxed posture, a sofa, or an upholstered chair.
21. *Mobility Preference* (MBP) describes learner tendency to move about and take breaks while studying, or to work until the task is finished. Need for mobility shows a modest negative correlation with Persistence Orientation (-.30). It may be both age-and-sex related, since younger learners and males seem to prefer greater mobility.
22. *Sound Preference* (SP) characterizes learner variations in reacting to auditory stimulation. Some learners have a need for quiet, while others use moderate background sound as a screen against other distractions. Almost no one learns well with excessive noise or loud music blaring.
23. *Lighting Preference* (LP) describes a learner's need for higher or lower levels of illumination. Bright light causes agitation or nervousness in some learners; dim light occasions drowsiness in others.
24. *Temperature Preference* (TP) characterizes a learner's choice to study in a warm or cool setting. Even small changes in temperature can significantly affect a student's motivation to study and learn. Some researchers argue that temperature and pressure senses within the body constitute a sixth perceptual system, the homeostatic system.

Instructional Applications

If a student has good cognitive skills, he or she is ready to learn efficiently and successfully. A student with weak cognitive skills will benefit little from an analysis and matching of other style elements; even supportive learning environments may be of little value.

Fortunately, cognitive skills can be strengthened. Many of the clinical training exercises developed by Charles Letteri (1985) for the augmentation of cognitive skills have been adapted for use in group settings. (See NASSP's *Learning Style Profile Handbook*. Volume I, Jenkins, Letteri & Rosenlund, 1990). Various ways also exist to enhance the learning environment for learner needs and preferences (See Volume II of the *Handbook*, Keefe, 1989). These strategies and activities are based on the field work of educators with wide experience in innovative schools.

The Learning Style Profile was developed as a *first-level diagnostic tool*. The scales are deliberately short in order to generate a range of information about each student. The Profile provides an overview of the tendencies and preferences of each learner (See Figure 3). LSP computer scoring programs automatically generate individual profiles and class rosters. They can also produce class (group) profiles and flag rosters if schools assign identification codes before testing.

Individual profiles are useful for advisement and are highly motivational to students. Flag rosters are particularly helpful for instructional planning. They list the

scores of a class or group using a set of abbreviations to "flag" the extremes on each subscale (Figure 4). Teachers can see at a glance the major tendencies and preferences, strengths and weaknesses of a given class and plan instruction accordingly. The flag roster also alerts teachers if a majority of students in a class or group are strong or weak, high or low on a particular subscale.

Teachers find diagnostic profiles helpful in organizing instruction for students with similar cognitive strengths or weaknesses, similar perceptual response tendencies, or similar instructional preferences. Students with analytic skill and categorization skill deficiencies, for example, may need focused problem solving training. Those with afternoon or evening study time preferences may function better in the morning with matched instructional and study preferences. Those with low verbal risk orientation may fare better in smaller groups where embarrassment is minimized and interaction can be optimized. This kind of careful diagnosis is the foundation of all really successful instructional planning.

Style-Based Instruction

Existing research suggests that students with very strong or very weak learning style skills, responses, or preferences are particularly amenable to instructional arrangements that optimize those capabilities. Students with strong cognitive skills, for example, are ready for challenging instruction and capable of working at or beyond grade level. Those with weak skills usually need help before they can learn successfully and feel good about further learning.

Planning learning style-based instruction involves several steps:

1. Diagnosing individual learning styles
2. Profiling class or group tendencies and preferences
3. Determining significant group strengths and weaknesses
4. Examining subject content for areas that may create problems for learners with weak skills
5. Analyzing student prior achievement scores and other products (curriculum-referenced tests, skill tests, portfolios, etc.) for patterns of weakness that may reflect cognitive skill deficiencies
6. Augmenting (remediating) weak cognitive skills using exercises like those in the *Learning Style Profile Handbook*, Volume I
7. Assessing current instructional methods to determine whether they are adequate or require more flexibility
8. Modifying the learning environment and developing personalized learning experiences like those in the *Learning Style Profile Handbook*, Volume II.

Steps 1-5 above are essentially diagnostic. Step 6 requires the enhancement or remediation of cognitive skill weaknesses. Augmentation or enhancement can be accomplished in two ways. Schools can establish a clinical center with one teacher trained as a cognitive resource teacher to work with students individually or in small groups. This approach is similar to the reading labs or resource rooms found in many schools.

Alternately, schools can train regular classroom teachers to help individuals or small groups in existing classrooms. Augmentation exercises developed at the University of Vermont, the University of Florida Laboratory School, Ohio State University, or NASSP may be used effectively with either approach. The following examples are taken from the *LSP Handbook*, Volume I.

Analytic Skill requires that learners break down an idea or problem into its component parts and then put it back together again. Students weak in analysis have difficulty recognizing the elements of a problem or task and may not know how to begin or proceed. Analysis involves skill in breaking down, sorting out, identifying and labeling parts, and seeing the parts in the whole.

❖ *Social Studies Example: Map Skills.* Writing verbal directions for getting from one place to another is an excellent exercise in analysis. Students must first understand the customary map symbols (mileage charts, borderlines, roads, landmarks, etc.). They must locate the point to begin their written directions and follow any guidelines. (Will the route be the fastest or the most scenic?) Teachers can model the first direction and then let students work independently. When everyone is finished, the results are shared and compared. (Which words seem to communicate the information most effectively?)

An analogous exercise for prospective administrative candidates would be planning a new school scheduling process.

Simultaneous Processing Skill is one of two modes of information processing available to and used by all individuals. (Sequential processing is the other.) Simultaneous processing strength involves grasping visuospatial relationships and seeing the bigger picture. It involves relational thinking—perceiving an overall pattern among component parts. Driving skills are the classic example of simultaneous processing; comprehending an elaborate plot from a complex descriptive narrative is another.

Steps 7-8 of style-based instruction involve modifying the learning environment to adapt instruction to the needs and preferences of learners. Differing strategies help students with particular style proclivities to respond to the demands of different kinds of learning. Volume II

of the *LSP Handbook* presents the following kinds of strategies.

Verbal Risk Orientation involves a willingness to express opinions in a group and to speak out even in the face of opposition. For introverts or slower learners, the group experience can be trying. Small groups of various kinds are good vehicles for encouraging verbal risk. The groups must be small enough to give everyone an opportunity to participate and still not allow the timid to hide.

❖ *Cooperative Learning Activities* are particularly useful in this regard. In the "Jigsaw" technique, for example, students are assigned to six-member teams to work on subject matter broken down into sections. Each student studies his or her section, meets with members of other teams with the same section in "expert groups," and then teaches his or her own teammates about the section. For more on cooperative learning activities, see Slavin (1983) and Johnson and Johnson (1984).

At-Risk Learners

Dropouts pose a big problem to schools and to society. The students in special education classes, the learning disabled (LD) and social-behavioral handicapped (SBH), are especially "at risk" for becoming dropouts. The research of Marlin Languis (1990), professor of education at Ohio State University and a co-author of the Learning Style Profile, indicates that learning-disabled students are weak in analytic, discrimination, and categorization skills. Social-behavioral handicapped students are weak in simultaneous processing and spatial skills (See Figure 5.)

Building skill in these cognitive strategies is not a quick fix, but it can be done. When students learn to control their cognitive processes better, their information processing actually changes and their school work improves. Learning style applications that help students "learn how to learn" can reduce the number of students who may otherwise choose to drop out of school.

Learning Style and Thinking

In recent years, many have claimed that American students cannot think effectively. Reports, books, and articles have been written supporting or describing programs about thinking. Contemporary approaches to the teaching of thinking use such terms as critical and creative thinking, thinking processes and skills, metacognitive and memory strategies. In general, all these labels define capabilities that enable individual students to manipulate knowledge and experience in useful and adaptive ways.

Thinking *processes*, for example, include concept and principle formation, comprehension, problem solving and decision making, research and composition skills, and the skills of verbal interaction. Thinking *skills* are more basic—the building blocks of thinking such as focusing and defining, gathering information, remembering, organizing and analyzing, generating and integrating new information, etc.

Many of these terms are no more than synonyms for various phases of the human information processing system. Processes such as attention, perception, memory, and operations such as integration, differentiation, association, and retrieval are internal to the system. Any discussion of improved thinking necessarily implies an understanding and application of cognitive processing. The ultimate success of the thinking skills movement, then, will depend almost entirely on the acceptance of a cognitive approach to school learning and instruction.

Some thinking programs concentrate on the thinking process itself and the skills and strategies needed to make it work. Others focus on problem solving—the higher end of the thinking continuum. Those which emphasize process are concerned with cognitive controls and learning to learn strategies. Those which favor the higher end of the continuum ignore cognitive controls (some seem not to know they exist) and emphasize the need for higher order skills in life and work.

Of course, both basic information processing skills and higher order problem-solving skills are needed. It is critical, however, to emphasize the importance of basic cognitive skills for school-based learning, of learning to learn skills in both school and life, and the developmental nature of human information processing. Students need at least some basic skills to engage in any higher order thinking. For truly effective critical and reflective thinking, for example, they need adequate content knowledge and functional skills at the lower levels to achieve consistent skill at the upper levels.

The cognitive trend is probably sufficiently established in contemporary thinking about human intelligence and cognitive/learning style that it will have a significant influence on the way instruction is planned and delivered. We may have to wait until the next century, however, for any recognizable change in the instructional system itself.

Learning style opens up new avenues for principals, teachers, and students to create caring and effective schools, places where learners and learning are important, where every student can be reasonably successful in acquiring the knowledge and skills necessary for a pro-

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ductive life. Many of the instructional implications of differing student styles have yet to be investigated, but one thing is certain: Students who understand their learning styles and who exercise active control over their cognitive skills do better in school. They are better adjusted, have more positive attitudes toward learning, and achieve at higher levels than do their less skillful peers. They take charge of their learning. That, needless to say, is the whole point of schooling.

Potential school administrators should be very knowledgable about the theory, assessment, and instructional application of learning style. So much of effective instructional leadership depends on administrators supporting teachers in successful approaches to instruction—based on the needs of individual learners. Knowing how students learn and like to learn is the foundation of this support.

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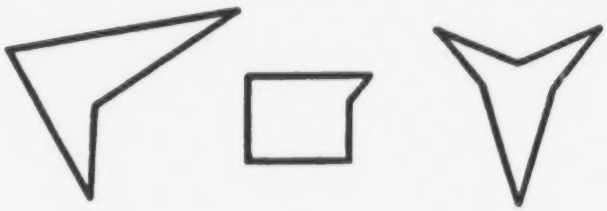
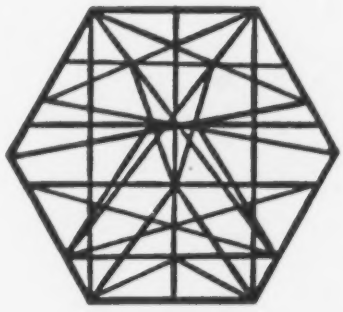
Appendix: A Sample Profile

Professors may wish to demonstrate some of the tasks and preferences used to assess learning style. The following pages contain a set of sample items very much like those on the NASSP Learning Style Profile. These items are not as discriminating as those on the Profile, but they do convey the type and format of the actual items in a straightforward way. Three cognitive skills are represented here (Analytic, Spatial, and Discrimination) and three typical study or instructional preferences (Persistence, Verbal Risk, Manipulative). Seven or more correct answers among the first nine items would suggest strong cognitive skills. The final items are self-explanatory. Answers to the questions will be found on the final page of the instrument.

1. One of the forms below is hidden in the complex figure. The hidden form is the same size, same shape, and facing the same way as one of the forms below. Select the correct hidden form.

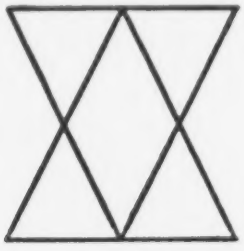


A. B. C.

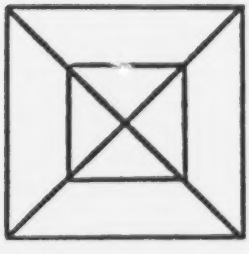


Complex Figure

How many triangles can you find in the shapes below?

2. 

A. 4 B. 5 C. 6 D. 7 E. 8

3. 

A. 4 B. 5 C. 10 D. 12 E. 16

In the center of this page is a sample circle. Compare the SIZE of the sample with the SIZE of each of the circles around it. Decide for each of the numbered circles if it is:

A. Smaller than the sample circle
B. Larger than the sample circle
C. The same size as the sample circle

Mark your answers below.

4.

7.

5.

Sample Circle

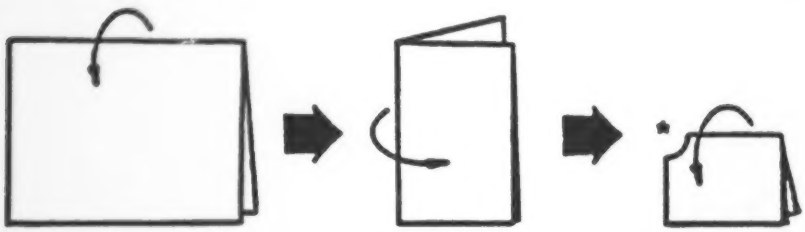
6.

4. A B C
5. A B C

6. A B C
7. A B C

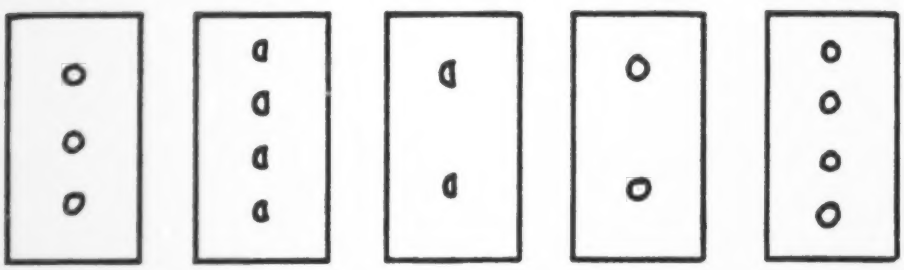
15

8. A piece of paper has been folded in the following ways. The star (*) shows where a part was cut out.

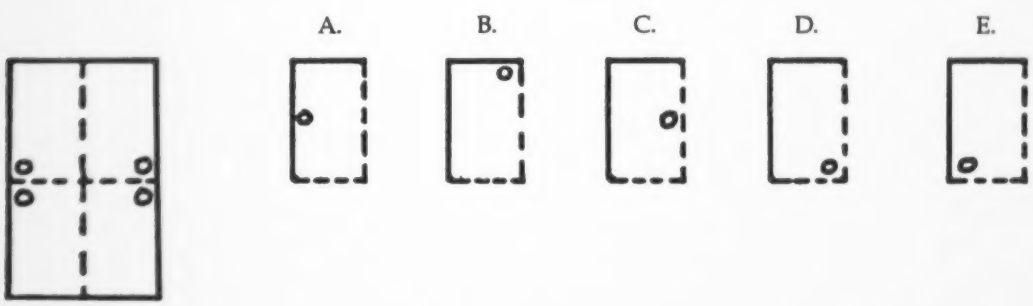


Which picture shows how the paper will look when it is unfolded?

A. B. C. D. E.



9. This sheet of paper has holes punched in it. How will the paper look after it is folded on the dotted lines?



For the remaining questions, read each sentence and select your answer from the following choices:

A. ALWAYS - This statement ALWAYS describes me.

B. USUALLY - This statement USUALLY describes me.

C. SOMETIMES - This statement SOMETIMES describes me.

D. RARELY - This statement RARELY describes me.

E. NEVER - This statement NEVER describes me.

10. I don't like to answer questions in class.

A. Always B. Usually C. Sometimes D. Rarely E. Never

11. I like to put things together.

A. Always B. Usually C. Sometimes D. Rarely E. Never

12. If I get stuck on an assignment, I give up on it.

A. Always B. Usually C. Sometimes D. Rarely E. Never

Answers:

1. C 2. C 3. E 4. C 5. A 6. C 7. B 8. D 9. E

10. Low (ALWAYS) to high (NEVER) verbal risk
11. High (ALWAYS) to low (NEVER) preference for hands-on learning activities
12. Low (ALWAYS) to high (NEVER) persistence

Figure 1. Information Processing, General Operations

Charles A. Letteri, 1982

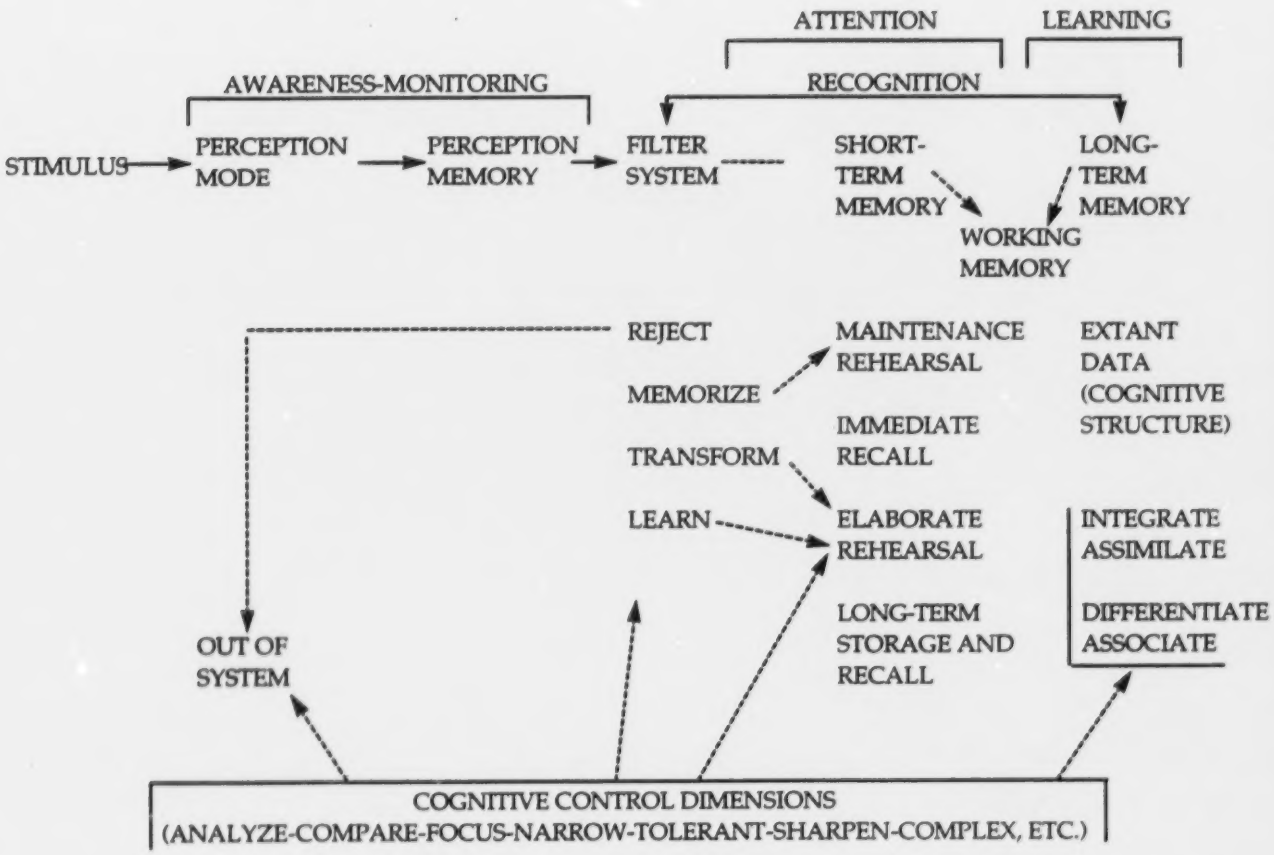


Figure 2. NASSP Learning Style Profile Subscale Relationships Based on a Human Information Processing Model (James W. Keefe, 1988)

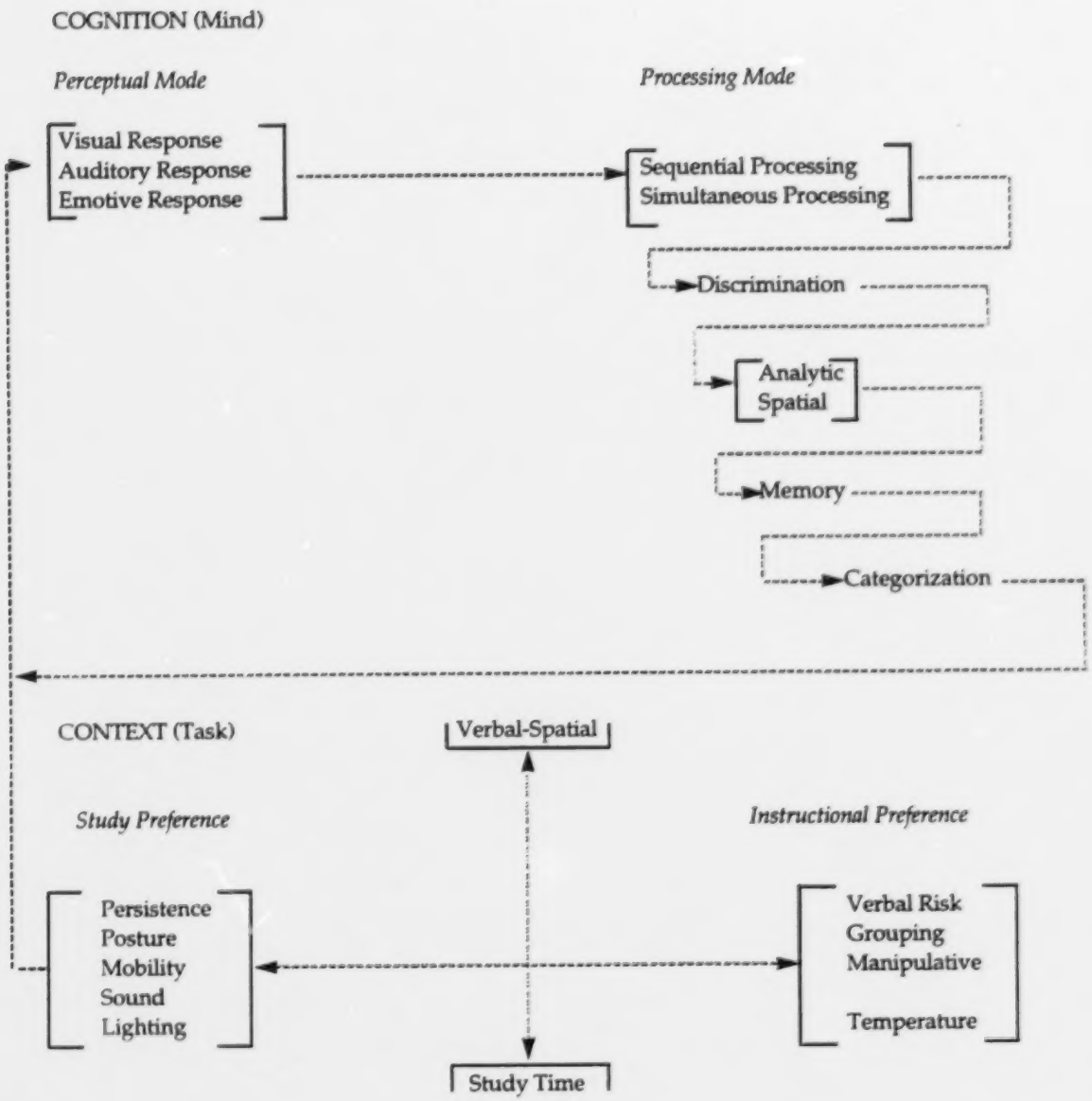


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Figure 3. Learning Style Profile

THIS PROFILE IS FOR:

BIRTHDATE: SEX: GRADE: RACE:

DATE: SCHOOL: CLASS:

SKILLS—GENERAL APPROACH TO PROCESSING INFORMATION

	SCORE	WEAK	AVERAGE		STRONG
ANALYTIC					
SPATIAL					
DISCRIMINATION					
CATEGORIZATION					
SEQUENTIAL					
MEMORY					
SIMULTANEOUS					

PERCEPTUAL RESPONSES—INITIAL RESPONSE TO VERBAL INFORMATION

	SCORE	WEAK	AVERAGE		STRONG
VISUAL					
AUDITORY					
EMOTIVE					

ORIENTATIONS AND PREFERENCES—PREFERRED RESPONSE TO STUDY OR INSTRUCTIONAL ENVIRONMENT

	SCORE	LOW	AVERAGE		HIGH
PERSISTENCE					
VERBAL RISK					
MANIPULATIVE					
STUDY TIME:					
EARLY MORNING					
LATE MORNING					
AFTERNOON					
EVENING					

	SCORE	HIGH	NEUTRAL		HIGH	
VERBAL-SPATIAL	SPATIAL					VERBAL
GROUPING	SMALL					LARGE
POSTURE	INFORMAL					FORMAL
MOBILITY	STILLNESS					MOVEMENT
SOUND	QUIET					SOUND
LIGHTING	DIM					BRIGHT
TEMPERATURE	COOL					WARM

CONSISTENCY SCORE: NORMATIVE SAMPLE:

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Figure 4. Flag Roster

NASSP Learning Style Profile Class Flag Roster

Date: 2/12/86 School: 21,000 Class: 20

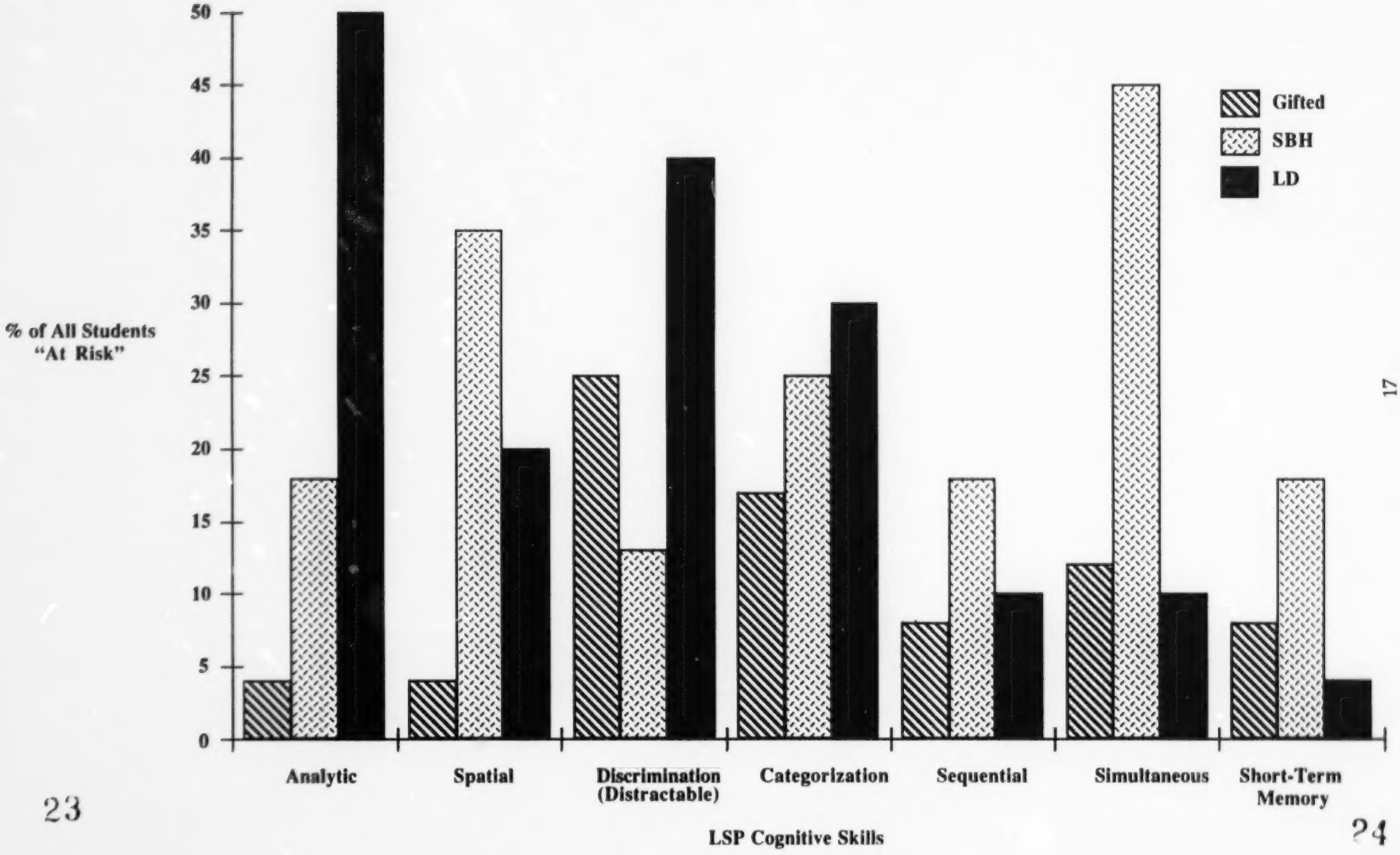
Name	Skills						Perceptual Response			Orientations			Study Time Preference				Other Preferences							Cons
	AN	SP	DI	CA	SE	ME	VI	AU	EM	PE	VR	MA	EM	LM	AF	EV	VA	GR	PO	MO	SO	LI	TE	
Armbrewster, John L.	S	S	W			W				H		H	H	H			—	S	I					3
Boris, Sherry A.	S	W	W		W	WW				L						L	—	S					C	3
Bradley, Christine M.								S		L		H		L			—				Q			4
Daniels, Chris A.							WW	S	S								—	S	I			D		2
Iberman, Dianna R.	S	S	W				WW	WW	WW				H	H			—	S				D	C	3
Jones, Nick G.									S						H		—		F		Q	D		3
Kent, Peter			W			S					L			L			—		F		S			8
Lawson, Jessica D.		S				S							L				—	S			Q	D		2
Leeks, Shari A.					W							LL				L	—	S	F	M	S	B	C	4
Leplace, Tiffany L.			WW			S							L				—	S						5
Loxley, Jennifer A.	W		W	W			S			L		LL		L	LL		—	SS	I			D	C	8
Maxton, Jimmy L.		S								L	HH	L	L	L			S			M	S			5
Milton, Shelly J.			WW				S	W		L						L	—	S			S			2
Purdy, James M.		S					S	W	W			H	H	H	H		S	S	F		Q		C	2
Rock, Richard R.	S	S					S	WW			LL	LL		H			S	SS	F	S	Q			1
Saylor, Sharon L.K.	W		W	W						L							—	S			S			2
Schmit, Daniel S.	W	S					WW	S					L		H		S		F					6
Settner, Lilly K.	S	S							W	H							S	S		S				3
Smith, David D.														H			—					D		7
Storke, Jimmy K.	S		W						W	L	L					L	S	S	F		Q	D	W	3
Tod, Allison K.			WW					W									—			S		D		2
Vargus, R. Charles	W	S				SS	W	S		LL	H		L				S	S	I		S	D		10
Wilson, Aaron D.	W		W			W		W		H		L		L	H	L	S	S						3
Wist, Lilly D.		S	WW	W		SS		W			H	H	H				—	S	F		Q	BB	C	1
All Class Members																	S	S						3

16

21

22

Figure 5: Special Education High School Students "At Risk" in LSP Cognitive Skills



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